

# 73rd MORSS CD Cover Page

UNCLASSIFIED DISCLOSURE FORM CD Presentation

712CD

For office use only 41205

21-23 June 2005, at US Military Academy, West Point, NY

**Please complete this form 712CD as your cover page to your electronic briefing submission to the MORSS CD. Do not fax to the MORS office.**

**Author Request (To be completed by applicant) - The following author(s) request authority to disclose the following presentation in the MORSS Final Report, for inclusion on the MORSS CD and/or posting on the MORS web site.**

Name of Principal Author and all other author(s): Nisha Shah and Suzanne Bergman

Principal Author's Organization and address:

Phone: 314-234-1196

Fax: 314-233-4433

Email: nisha.r.shah@boeing.com

Original title on 712 A/B: *GPS Decision Analysis Process*

Revised title: \_\_\_\_\_

Presented in (input and Bold one): (**WG 28**, CG\_\_\_\_, Special Session \_\_\_\_, Poster, Demo, or Tutorial):

This presentation is believed to be:  
**UNCLASSIFIED AND APPROVED FOR PUBLIC RELEASE**

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>23 JUN 2005</b>		2. REPORT TYPE <b>N/A</b>		3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>GPS Decision Analysis Process</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>The Boeing Company</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>See also ADM201946, Military Operations Research Society Symposium (73rd) Held in West Point, NY on 21-23 June 2005 . , The original document contains color images.</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>UU</b>	18. NUMBER OF PAGES <b>24</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

# GPS Decision Analysis Process

Nisha Shah  
The Boeing Company  
73<sup>rd</sup> MORS Symposium  
US Military Academy – West Point  
21-23 June 2005

# GPS Decision Analysis Objectives



Boeing Technology | Phantom Works

Strategic Development & Analysis

- Understand the Customer Value Structure in the Area of GPS-Related Military Tasks
  - Identify High Leverage Military Tasks for A Specific GPS Technology
    - Identify Important Military Tasks with Performance Gaps
    - Highlight Tasks for Which Competing Approaches Are Insufficient
- Identify Cost, Technical Risk and Political Risk Implications for Military Task Completion Using A Specific GPS Technology

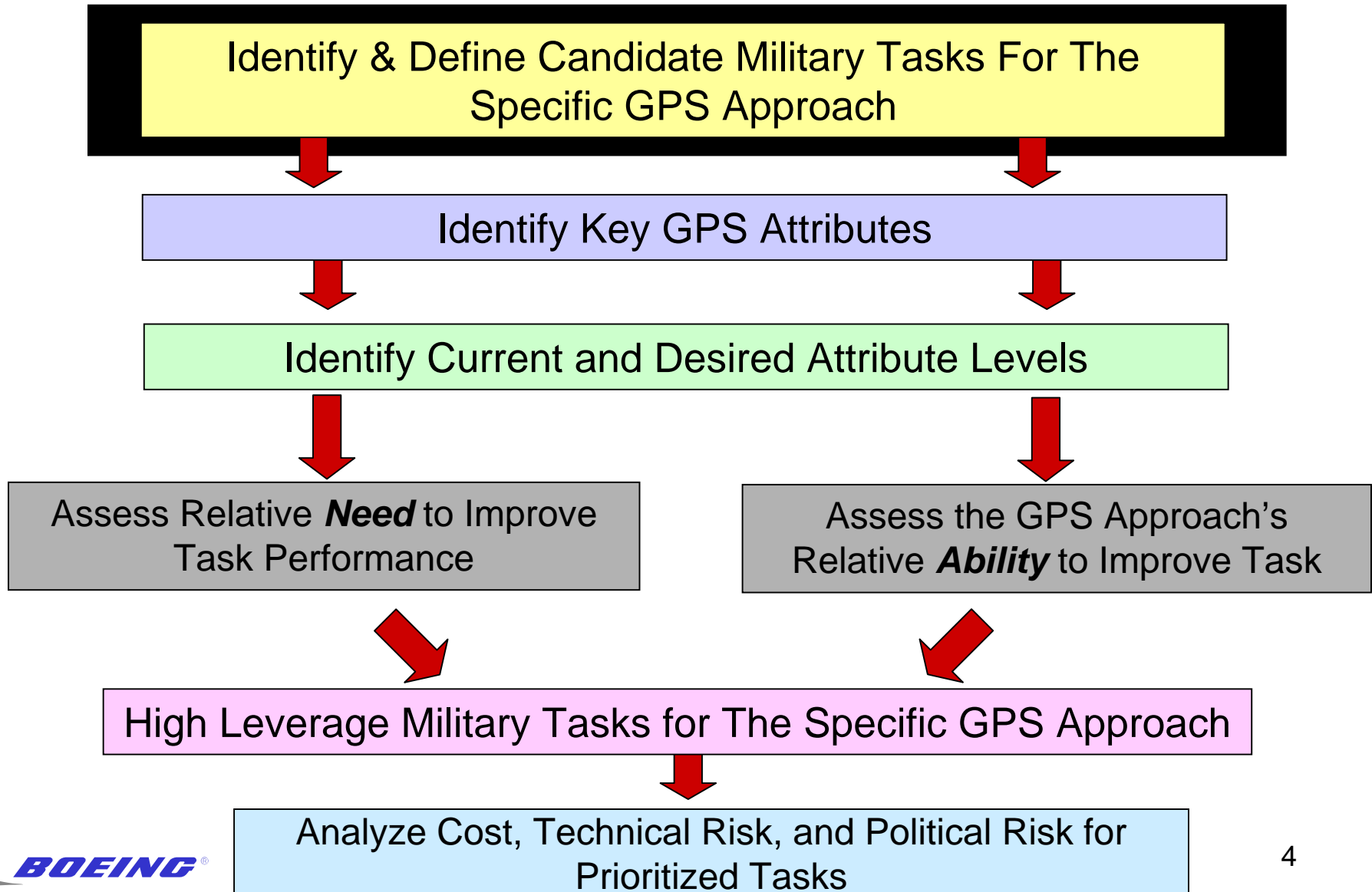
**Maintain a Non-Advocate Perspective. All Decisions Made Throughout the Process Were Based On Consensus.**

# GPS Decision Analysis Approach



Boeing Technology | Phantom Works

Strategic Development & Analysis



# Military Tasks



Boeing Technology | Phantom Works

Strategic Development & Analysis

- Precisely Navigate In Urban/Low-Signal Settings
- Precisely Navigate Weapons From Airborne Assets
- Precisely Navigate Weapons From Ground-Based Assets
- Precisely Locate Urban Targets

■ ■ ■ ■ ■

# Notional

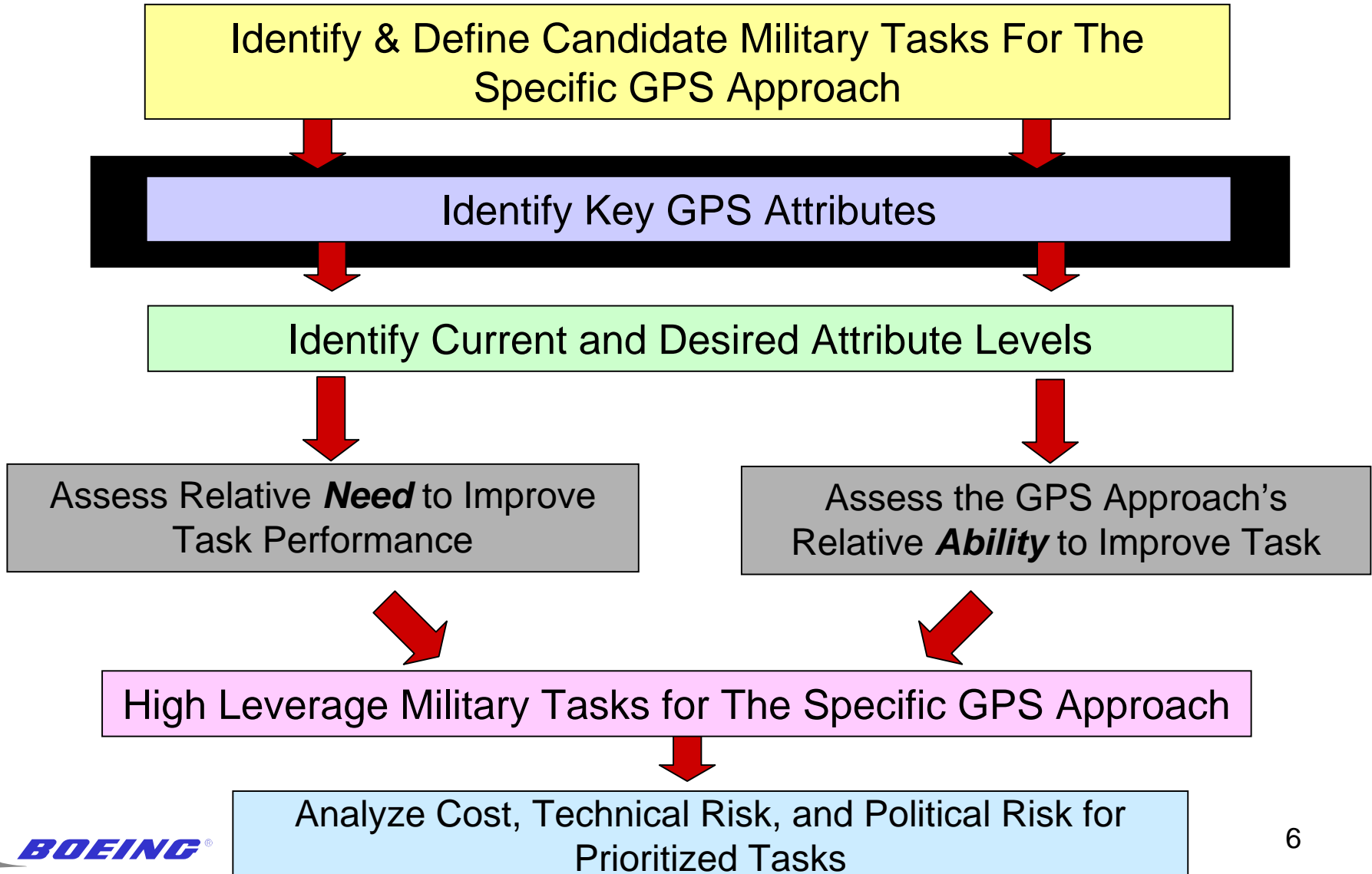
The Results of a Internal Survey of Subject Matter Experts Were Compiled, and Later Reviewed and Revised to Create the List of Potential Military Tasks for The Specific GPS Technology

# GPS Decision Analysis Approach



Boeing Technology | Phantom Works

Strategic Development & Analysis



# Attributes



- Attributes Represent Different GPS-Related Performance Parameters
  - Attribute A
  - Attribute B
  - Attribute C
  - Attribute D
  - Attribute E
  - Attribute F
- Performance Levels (1-5) For Each Attribute Were Defined For Each of the GPS Approaches
- A Performance Level of 5 Represented Highest Possible Performance In Terms of the Given Attribute
- A Performance Level of 1 Represented Lowest Possible Performance In Terms of the Given Attribute

For Example, Accuracy May Be A Key GPS-Related Performance Parameter. Our Specific GPS Technology May Reach a Performance Level of 5 In Terms of Accuracy.



# Attribute Performance Levels



Boeing Technology | Phantom Works

Strategic Development & Analysis

The Attribute Performance Levels for Our Specific Approach and Competing Approaches Were Defined

Approach	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Specific GPS Approach	PL 5	PL 5	PL 5	PL 3	PL 4	PL 5
Competing Approach 1	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1
Competing Approach 2	PL 5	PL 5	PL 1	PL 2	PL 2	PL 1
Competing Approach 3	PL 3	PL 2	PL 3	PL 3	PL 2	PL 3
Competing Approach 4	PL 2	PL 2	PL 1	PL 3	PL 2	PL 3
Competing Approach 5	PL 3	PL 5	PL 1	PL 5	PL 2	PL 1
Competing Approach 6	PL 2	PL 3	PL 1	PL 3	PL 4	PL 3
Competing Approach 7	PL 3	PL 3	PL 3	PL 3	PL 2	PL 3
Competing Approach 8	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1

Notional

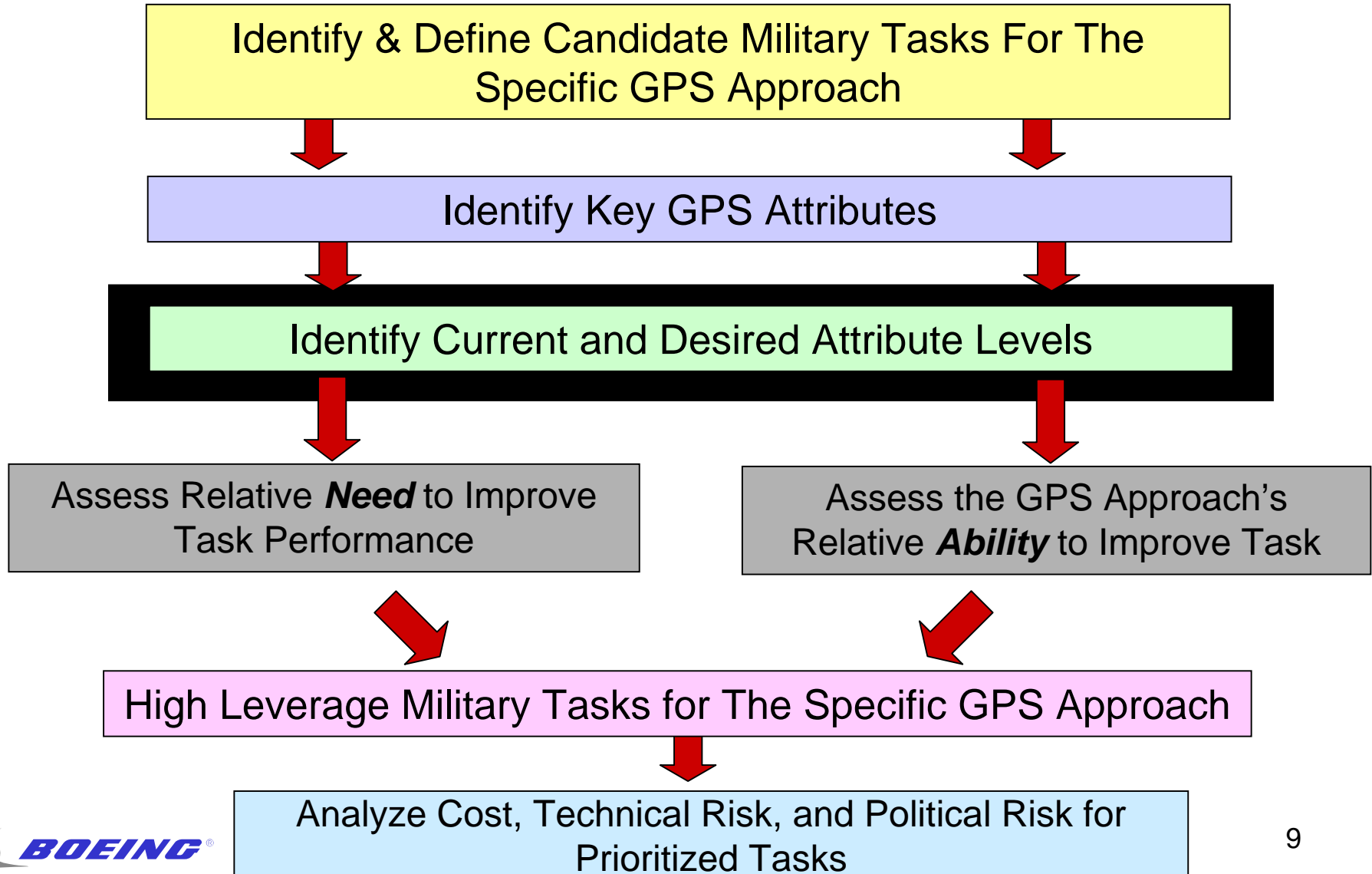
The Above Table Shows the Attribute Performance Levels For Our Specific GPS Approach As Well As For Competing Approaches. Competing Approaches Include Both Options That Are Currently Operational And Those That Will Be Operational In the Near Future

# GPS Decision Analysis Approach



Boeing Technology | Phantom Works

Strategic Development & Analysis



# Current and Desired Attribute Levels



Boeing Technology | Phantom Works

Strategic Development & Analysis

Task	Current Approach	Attribute A		Attribute B		Attribute C		Attribute D		Attribute E		Attribute F	
		Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level
Precisely Navigate in Urban/Low Signal Settings	Competing Approach 6	PL 2	PL 2	PL 3	PL 4	PL 1	PL 5	PL 3	PL 4	PL 4	PL 5	PL 3	PL 4

What is the Sure Desired Attribute Level?

Approach	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Specific GPS Approach	PL 5	PL 5	PL 5	PL 3	PL 4	PL 5
Competing Approach 1	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1
Competing Approach 2	PL 5	PL 5	PL 1	PL 2	PL 2	PL 1
Competing Approach 3	PL 3	PL 2	PL 3	PL 3	PL 2	PL 3
Competing Approach 4	PL 2	PL 2	PL 1	PL 3	PL 2	PL 3
Competing Approach 5	PL 3	PL 5	PL 1	PL 5	PL 2	PL 1
Competing Approach 6	PL 2	PL 3	PL 1	PL 3	PL 4	PL 3
Competing Approach 7	PL 3	PL 3	PL 3	PL 3	PL 2	PL 3
Competing Approach 8	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1

Notional

# GPS Decision Analysis Approach



Boeing Technology | Phantom Works

Strategic Development & Analysis

Identify & Define Candidate Military Tasks For The Specific GPS Approach

Identify Key GPS Attributes

Identify Current and Desired Attribute Levels

Assess Relative **Need** to Improve Task Performance

Assess the GPS Approach's Relative **Ability** to Improve Task

High Leverage Military Tasks for The Specific GPS Approach

Analyze Cost, Technical Risk, and Political Risk for Prioritized Tasks

# Relative Need For Task Improvement



Boeing Technology | Phantom Works

Strategic Development & Analysis

Task	Implicit Importance of Task	Gap Between Current and Desired Capabilities	Relative Need For Task Improvement
Precisely Navigate in Urban/Low Signal Settings	M	M	M

From the Perspective of the JFC, What Is the Implicit Importance of "Precisely Navigate in Urban/Low Signal Settings?"

What Is the Gap Between Current and Desired Capabilities in the Area of "Precisely Navigate in Urban/Low Signal Settings?"

Based on Both the Implicit Importance and the Gap Between Current and Desired Capabilities, What Is the Overall Relative Need for Task Improvement?

Notional

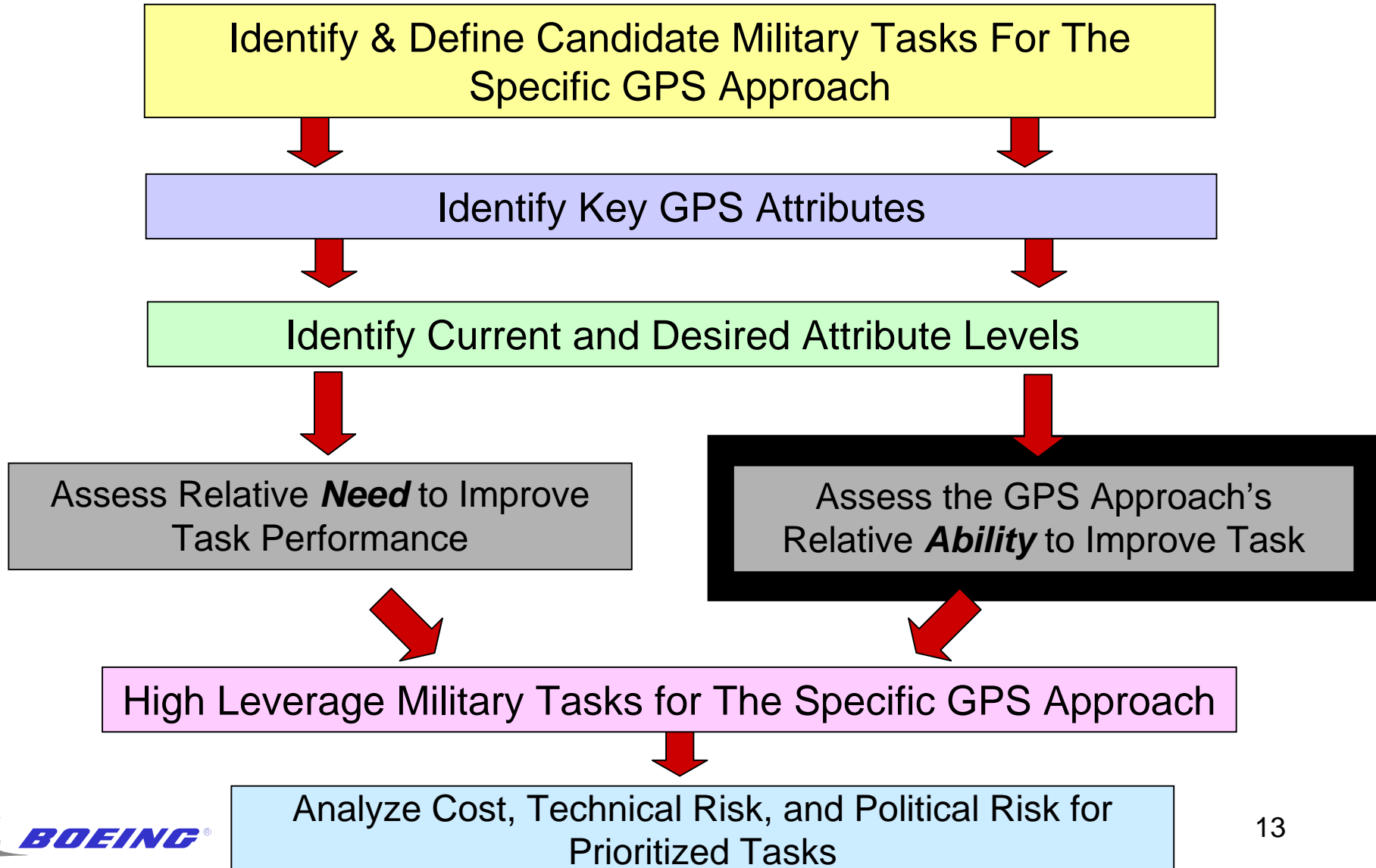
Task	Current Approach	Attribute A		Attribute B		Attribute C		Attribute D		Attribute E		Attribute F	
		Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level
Precisely Navigate in Urban/Low Signal Settings	Competing Approach 6	PL 2	PL 2	PL 3	PL 4	PL 1	PL 5	PL 3	PL 4	PL 4	PL 5	PL 3	PL 4

# GPS Decision Analysis Approach



Boeing Technology | Phantom Works

Strategic Development & Analysis



# Relative Ability of Specific GPS Approach



Boeing Technology | Phantom Works

Strategic Development & Analysis

## Precisely Navigate In Urban/Low Signal Settings

	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Desired Attribute Level	PL 2	PL 4	PL 5	PL 4	PL 5	PL 4

Notional

## For This Task, Can the GPS Approach Perform to the Desired Attribute Level?

	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F	Sum "yes"
Specific GPS Approach	yes	yes	yes	no	no	yes	4
Competing Approach 1	yes	no	no	no	no	no	1
Competing Approach 2	yes	yes	no	no	no	no	2
Competing Approach 3	yes	no	no	no	no	no	1
Competing Approach 4	yes	no	no	no	no	no	1
Competing Approach 5	yes	yes	no	yes	no	no	3
Competing Approach 6	yes	no	no	no	no	no	1
Competing Approach 7	yes	no	no	no	no	no	1
Competing Approach 8	yes	no	no	no	no	no	1

Best Approach

Approach	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Specific GPS Approach	R.5	R.5	R.5	R.3	R.4	R.5
Competing Approach 1	R.5	R.3	R.2	R.3	R.2	R.1
Competing Approach 2	R.5	R.5	R.1	R.2	R.2	R.1
Competing Approach 3	R.3	R.2	R.3	R.5	R.2	R.3
Competing Approach 4	R.2	R.2	R.3	R.2	R.2	R.3
Competing Approach 5	R.3	R.5	R.1	R.5	R.2	R.1
Competing Approach 6	R.2	R.3	R.3	R.3	R.4	R.3
Competing Approach 7	R.3	R.3	R.3	R.3	R.2	R.3
Competing Approach 8	R.5	R.3	R.2	R.3	R.2	R.1

Next Best Approach

Number of Attributes That The Specific GPS Approach Can Perform to the Desired Level

4

= 1.33

Number of Attributes That The Next Best Approach Can Perform to the Desired Level

3

Relative Ability is Low

How Much Better is The Specific GPS Approach Than the Next Leading Approach?

1 to <2 Times Better

Ability is Low

2 to <4 Times Better

Ability is Medium

>4 Times Better

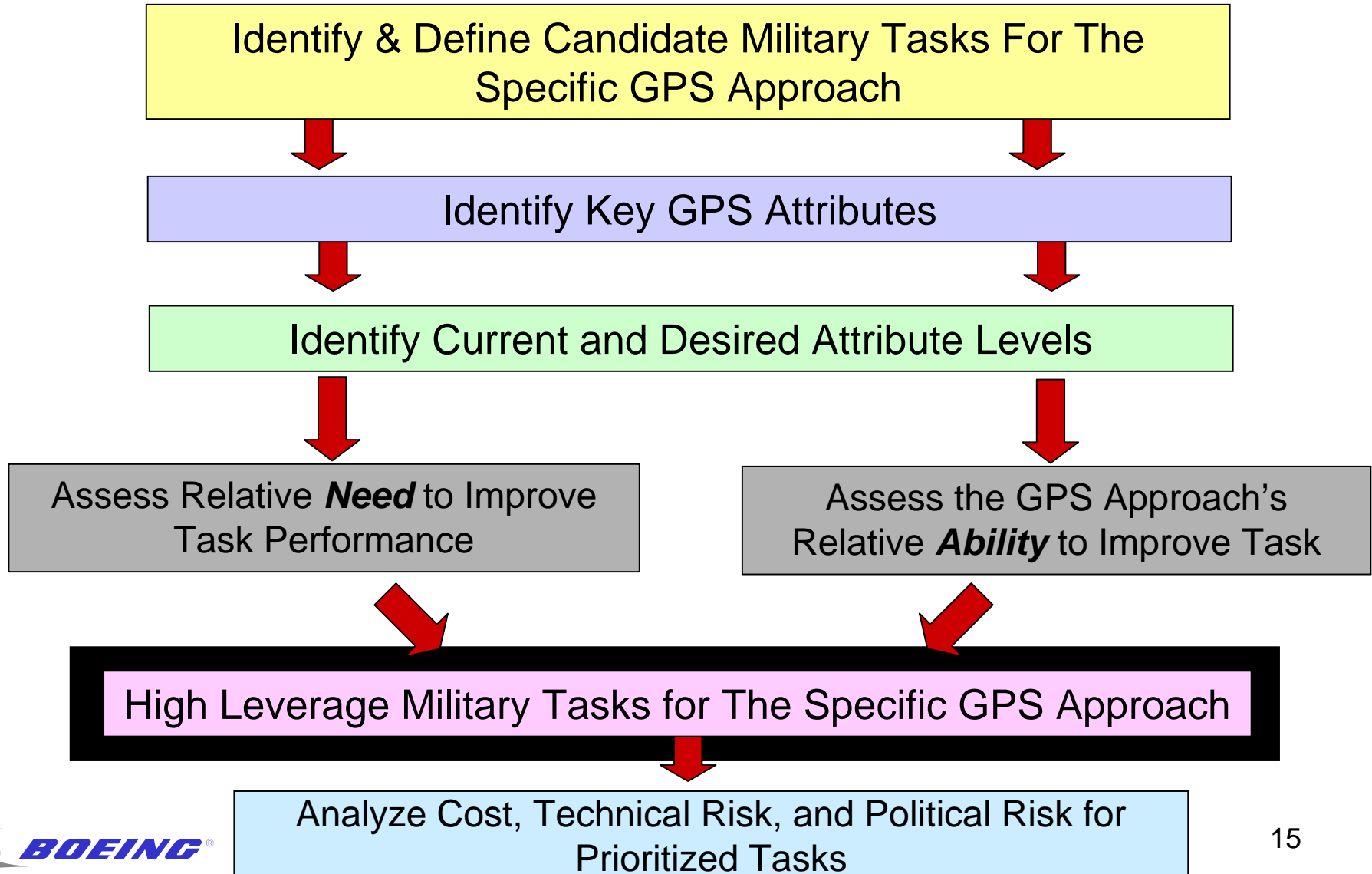
Ability is High

# GPS Decision Analysis Approach



Boeing Technology | Phantom Works

Strategic Development & Analysis





# Military Task Prioritization



Boeing Technology | Phantom Works

Strategic Development & Analysis

## Precisely Navigate in Urban/Low Signal Settings

Relative Ability For Approach to Improve Task is Low

Relative **Ability**

Relative Need For Task Improvement is Medium

Grid Emphasizes Tasks For Which There Exists A High Relative Need For Task Improvement and Our Specific GPS Approach Has a High Relative Ability to Improve.

Task Priority

Relative **Need** For Task Improvement

	L	M	H
L	1	2	4
M	2	4	8
H	4	8	16

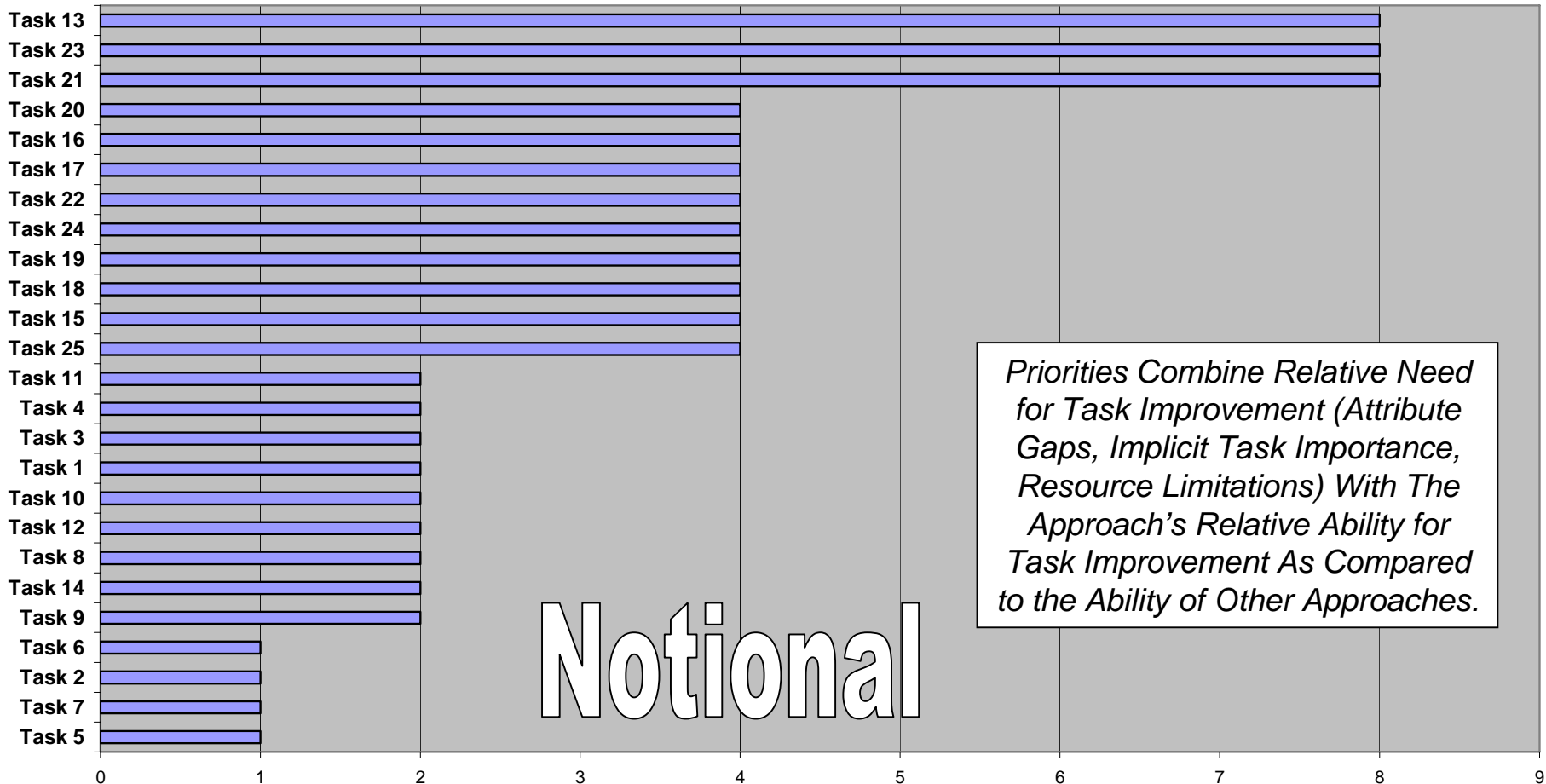
Notional

# Prioritized Military Tasks For Specific GPS Technology



Boeing Technology | Phantom Works

Strategic Development & Analysis



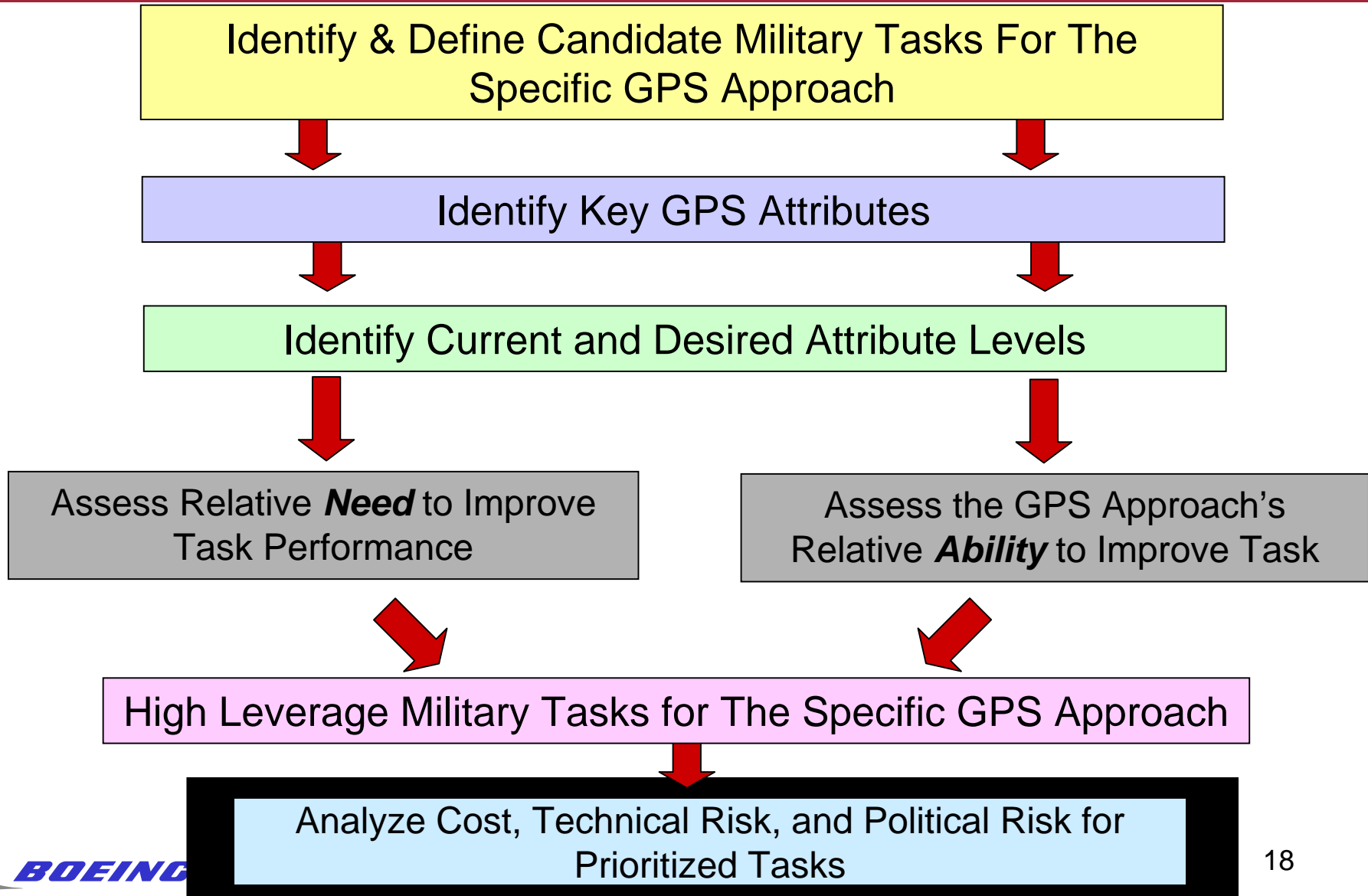
**Task Priorities Are Relative to Each Other And Are the Result of a Facilitated Decision Analysis Process**

# GPS Decision Analysis Approach



Boeing Technology | Phantom Works

Strategic Development & Analysis





## Precisely Navigate in Urban/Low Signal Settings:

- What Level Of Technical Risk Is Associated With Task Performance With Our Specific GPS Approach?

Low

- What Level Of Political/Regulatory Risk Is Associated With Task Performance With Our Specific GPS Approach?

Medium

- What Level Of Relative Cost Is Associated With Task Performance With Our Specific Approach?

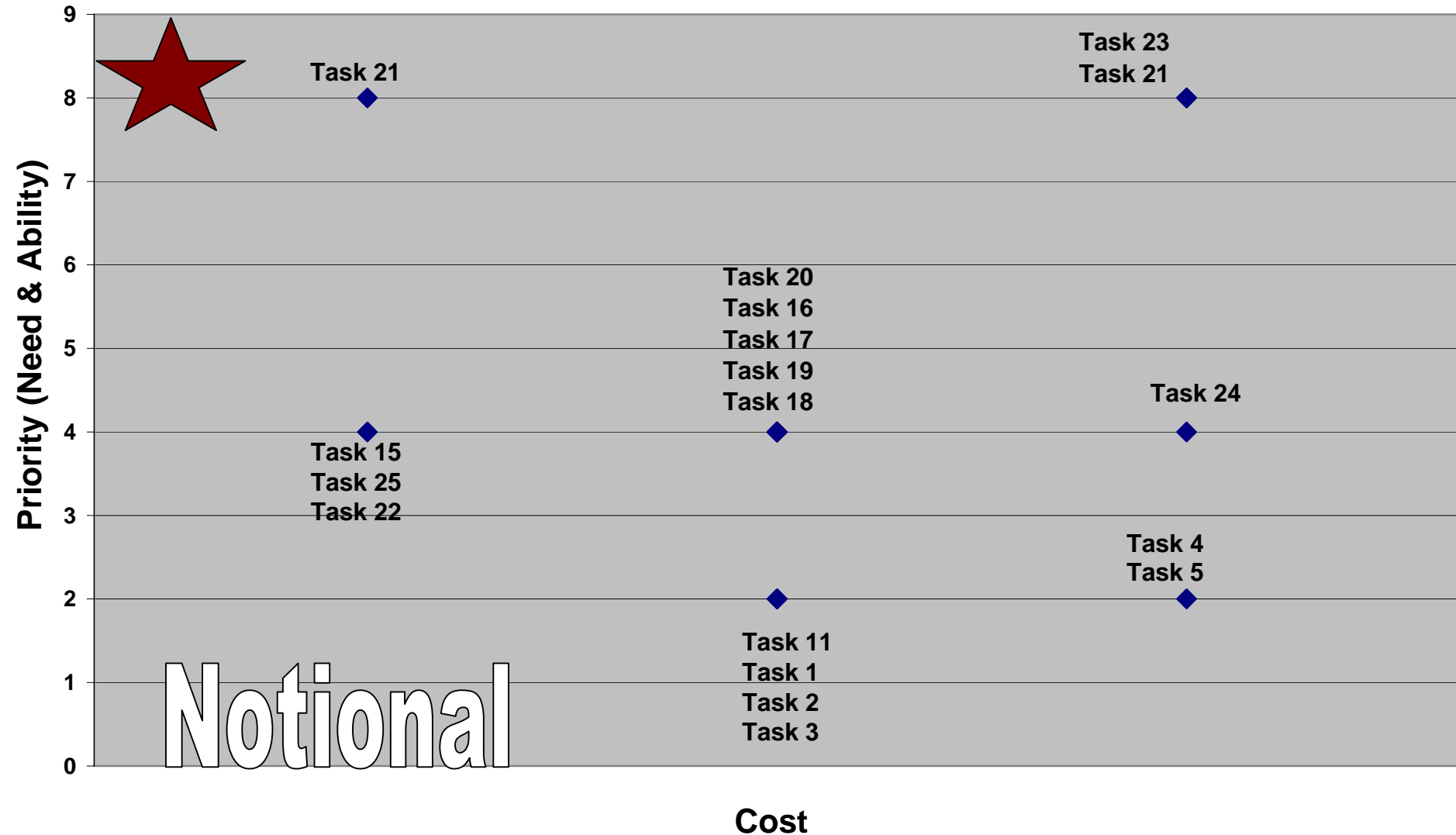
High

# Military Tasks and Cost



Boeing Technology | Phantom Works

Strategic Development & Analysis



# Conclusions



- Process Aided in Understanding the Customer Value Structure in the Area of GPS-Related Military Tasks
- Process Aided In Identifying Areas For Further, More In-Depth Research
- Process Allowed For a Top-Level Assessment of Technical Risk, Political Risk, and Cost
- GPS Technologists Utilized the Results of This Activity To Further Analyze the Performance of High Priority Military Tasks Using the Specific GPS Approach

# Questions



Boeing Technology | Phantom Works

Strategic Development & Analysis





**Boeing Technology**  
Phantom Works

Phantom

Backup



# Current And Desired Attribute Levels



Boeing Technology | Phantom Works

Strategic Development & Analysis

## Precisely Navigate in Urban/Low Signal Settings

Current Approach	Attribute A		Attribute B		Attribute C		Attribute D		Attribute E		Attribute F	
Competing Approach 6	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level	Current Level	Desired Level
	PL 2	PL 2	PL 3	PL 4	PL 1	PL 5	PL 3	PL 4	PL 4	PL 5	PL 3	PL 4

What is the Desired Attribute Level?

Approach	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Specific GPS Approach	PL 5	PL 5	PL 5	PL 3	PL 4	PL 5
Competing Approach 1	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1
Competing Approach 2	PL 5	PL 5	PL 1	PL 2	PL 2	PL 1
Competing Approach 3	PL 3	PL 2	PL 3	PL 3	PL 2	PL 3
Competing Approach 4	PL 2	PL 2	PL 1	PL 3	PL 2	PL 3
Competing Approach 5	PL 3	PL 5	PL 1	PL 5	PL 2	PL 1
Competing Approach 6	PL 2	PL 3	PL 1	PL 3	PL 4	PL 3
Competing Approach 7	PL 3	PL 3	PL 3	PL 3	PL 2	PL 3
Competing Approach 8	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1